



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/586,909	01/08/2007	Noritaka Muraki	Q79714	1815
23373 7590 01/07/2010 SUGHRUE MION, PLLC 2100 PENNSYLVANIA AVENUE, N.W. SUITE 800 WASHINGTON, DC 20037				
EXAMINER HUBER, ROBERT T				
ART UNIT 2892		PAPER NUMBER		
NOTIFICATION DATE 01/07/2010		DELIVERY MODE ELECTRONIC		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

sughrue@sughrue.com
PPROCESSING@SUGHRUE.COM
USPTO@SUGHRUE.COM

Office Action Summary

Application No.

10/586,909

Applicant(s)

MURAKI ET AL.

Examiner

ROBERT HUBER

Art Unit

2892

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 October 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1.5-17 and 19-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1.5-17 and 19-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 May 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB06)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Paper No(s)/Mail Date _____
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 22, 2009 has been entered.

Claim Objections

2. The Examiner acknowledges the amendment(s) to claim 1 filed on October 22, 2009. The objection(s) to claims 1, 5 – 17, and 19 – 22 cited in the previous office action filed on June 22, 2009 is (are) hereby withdrawn.

Claim Rejections - 35 USC § 112

3. The Examiner acknowledges the amendment(s) to claim 1 filed on October 22, 2009. The rejection of claim(s) 1, 5 – 17, and 19 – 22 under USC 112, second paragraph, cited in the previous office action filed on June 22, 2009 is (are) hereby withdrawn.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1, 5 – 17, and 19 – 22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, claim 1 recites in the last line of the claim that the at least one gallium nitride compound semiconductor well layer is a discontinuous layer including "*a portion having a thickness of 0 nm*". It is unclear and ambiguous if the portion having a thickness of 0 nm may have a thickness of less than 0 nm, for example, such as 0.1 nm (or 1 Angstrom), or if the thickness is completely zero (i.e. no thickness). A best-deemed interpretation is made based on the specification (e.g. page 13, which describes the well layer to have a portion that is not present) and the "*a portion having a thickness of 0 nm*" is interpreted as "*a portion having zero thickness, such that the at least one gallium nitride compound semiconductor layer is absent a portion*". Claims 5 – 17 and 19 – 22 depend from claim 1.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1, 5, 9 – 11, 16, 17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (US 6,608,330 B1, prior art of record) in view of Sasaoka (US 2003/0042496 A1, prior art of record) and Stintz et al. (US 2002/0114367 A1).

- a. Regarding claim 1, **Yamada discloses a gallium nitride compound semiconductor light-emitting device** (e.g. figure 1) **comprising**
- a crystalline substrate** (substrate 101);
- a light-emitting layer of a multiple quantum well structure** (multiple quantum well structure comprising layers 107 and 108) **that is formed of at least one gallium nitride compound semiconductor barrier layer doped with an impurity element** (layers 107, disclosed in col. 11, lines 7 – 8 to be formed of GaN, InGaN, AlGaN, or the like. E.g. AlGaN may be considered to be doped GaN with impurity element Al) **and at least one gallium nitride compound semiconductor well layer undoped with any impurity element** (layers 108, disclosed in col. 10, lines 3 – 4 to be undoped), **said light-emitting layer being provided on a second side of the crystalline substrate** (e.g. as seen in figure 1);

a contact layer formed of a Group III-V compound semiconductor for providing an Ohmic electrode for supplying device operation current to the light-emitting layer (layer 111, formed from GaN as stated in col. 8, line 41); and

an Ohmic electrode (electrode 112)) that is provided on the contact layer (e.g. as seen in figure 1) and has an aperture through which a portion of the contact layer is exposed (e.g. as seen in figure 1, the sides of electrode 112 are open, exposing the contact layer 111),

wherein the Ohmic electrode exhibits light permeability with respect to light emitted from the light-emitting layer (col. 10, line 42 discloses the electrode 112 to be transparent), the individual gallium nitride compound semiconductor well layers of the multiple quantum well structure each has the same composition (e.g. as seen in figure 1, there are multiple gallium nitride compound semiconductor well layers 108. Since the multiple well layers are all designated as a well layer 108, it is anticipated they are all of the same structure and all have the same composition) and contains a thick portion having a large thickness (e.g. col. 13, lines 16 - 36, with reference to figure 6, disclose that the well layers have both thin and thick regions), and a thin portion having a thickness 1.5 nm or less (col. 13, lines 20 - 22 disclose that, with reference to figure 6, disclose that the well layers have regions with thickness less than half of the average thickness. Col. 9, lines 35 - 36 discloses the

average thickness of a well layer to be 3 nm. Therefore, the regions defined by "D" in figure 6 of the well layers are less than 1.5 nm);

wherein the at least one gallium nitride compound semiconductor well layer is a discontinuous layer (A common definition of "discontinuous" is "marked by breaks or interruptions". col. 13, lines 20 – 22 disclose that, with reference to figure 6, the well layer may be considered as having "breaks" or "interruptions" in regions with lower thicknesses than other regions, and there for the well layer may be considered as "discontinuous").

Yamada is silent with respect to explicitly disclosing the at least one gallium nitride compound semiconductor well layer includes a portion having zero thickness, such that the at least one gallium nitride compound semiconductor layer is absent a portion (see 112 2nd rejection above). However, Yamada does disclose the at least one gallium nitride compound semiconductor layer may have a thickness of "less than a half of an average thickness" of the layer (page 13, lines 20 - 23).

Stintz discloses that a gallium compound semiconductor well layer of a light emitting device may have a portion having zero thickness, such that the at least one gallium nitride compound semiconductor layer is absent a portion (as seen in figure 11C, layer 408 has portions that are zero thickness, such that layers 406 exists between the layer 408).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the device of Yamada such that the at least

one gallium nitride compound semiconductor well layer includes a portion having zero thickness, such that the at least one gallium nitride compound semiconductor layer is absent a portion, since Yamada discloses the layer to have portions with a thickness of less than half the average thickness of the layer, and a zero thickness is less than half the average thickness. And, it has been held that in the case where the claimed ranges overlap or lie inside the ranges disclosed by the prior art, then a prima facie case of obviousness exists (See MPEP 2144.05). Furthermore, Stintz discloses that quantum well layers may be discontinuous such that there are regions of the layer with zero thickness. One would have been motivated to have a portions of the well layer with zero thickness in order to create quantum confinement regions that would alter the characteristics of the light emitting layer, allowing one to control and optimize the light emitted by the device (as seen in figure 12 of Stintz).

Yamada is also silent with respect to disclosing the barrier layer is doped with a Group IV element at an average atom density of $1 \times 10^{17} \text{ cm}^{-3}$ to $5 \times 10^{18} \text{ cm}^{-3}$.

Sasaoka discloses a gallium nitride compound semiconductor light-emitting device with barrier layer being doped with a Group IV element at an average atom density of $1 \times 10^{17} \text{ cm}^{-3}$ to $5 \times 10^{18} \text{ cm}^{-3}$ which exhibits a low resistance (¶ [0109] discloses the barrier layer to be Si doped with a concentration of $1 \times 10^{18} \text{ cm}^{-3}$).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Yamada such that the barrier layers are doped with a Group IV compound with a density of $1 \times 10^{17} \text{ cm}^{-3}$ to $5 \times 10^{18} \text{ cm}^{-3}$ since it was known that gallium nitride compound light emitting devices can contain quantum well layers comprising barrier layers with such dopant and concentrations, as disclosed by Sasaoka. One would have been motivated to make the barrier layer with a dopant of Group IV materials since these would create an n-type semiconductor barrier layer, allowing one to control the conductivity of the barrier layer, resulting in a more efficient light emission properties of the quantum well.

Regarding the limitation of doping the barrier layer “*for the purpose of decreasing forward voltage of the device*”, this is regarded as a statement of intended use, and it has been held by the courts that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex parte Masham 2 USPQ2d 1647 (1987). See MPEP 2114.

b. Regarding claim 5, **Yamada in view of Sasaoka and Stintz further disclose a gallium nitride compound semiconductor light-emitting device, as cited above, wherein the predetermined impurity element added only to the barrier layer is silicon** (Yamada: col. 10, lines 3 – 7, disclose that the layer

108 may be doped with Silicon. Col. 9, line 62 discloses the layer 108 may be a barrier layer).

c. Regarding claim 9, **Yamada in view of Sasaoka and Stintz disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, however Yamada is silent with respect to the contact layer having a thickness of 1 μm to 3 μm , however Yamada discloses that the contact layer thickness is 0.25 μm .**

It would have been obvious to one of ordinary skill in the art at the time the invention was made to enlarge the layer thickness of Yamada in view of Sasaoka, since it has been held by the courts that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device, and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. *In Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984). One would be motivated to make such a modification of the layer thickness in order to make the device structurally more rigid.

d. Regarding claim 10, **Yamada in view of Sasaoka and Stintz disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, wherein the Ohmic electrode (18) exhibits a**

transmittance at the wavelength of emitted light of 30% or higher (the structure of Yamada in view of Sasaoka are obvious over the structure of the claimed invention, therefore Yamada in view of Sasaoka are obvious over the properties of the light transmittance of the Ohmic electrode, since it has been held that when the prior art discloses the structure of the claimed invention, a prima facie case of anticipation or obviousness of the inherent properties has been established. See MPEP 2112.01.)

e. Regarding claim 11, **Yamada in view of Sasaoka and Stintz further disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, wherein the Ohmic electrode has a thickness of 1 nm to 100 nm** (Yamada: col. 10, lines 42 – 43, disclose the electrode has a thickness of 20 nm).

f. Regarding claims 16 and 17, **Yamada in view of Sasaoka and Stintz further disclose a lamp and an LED employing the gallium nitride compound semiconductor light-emitting device according to claim 1** (Yamada: col. 11, lines 25 – 36).

g. Regarding claim 19, **Yamada in view of Sasaoka and Stintz further disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, wherein the at least one barrier layer**

is an Si-doped n-type GaN barrier layer (Sasaoka: ¶ [0109] discloses the Group IV doped GaN barrier layer to be Si doped n-type GaN).

9. Claims 6 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada in view Sasaoka and Stintz, as cited above with respect to claim 1, and in further view of Hanaoka et al. (US 5,804,839, prior art of record).

a. Regarding claim 6, **Yamada in view of Sasaoka and Stintz disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above. However, Yamada, Sasaoka, and Stintz are silent with respect to the contact layer being doped with an n- type impurity element and has a carrier concentration of $5 \times 10^{18} \text{ cm}^{-3}$ to $2 \times 10^{19} \text{ cm}^{-3}$.**

Hanaoka teaches that GaN layers may be formed with n-type impurity concentrations of $1 \times 10^{19} \text{ cm}^{-3}$ (col. 9, lines 20 - 23).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the contact layer of Yamada in view Sasaoka and Stintz to include n-type impurities with a concentration of $1 \times 10^{19} \text{ cm}^{-3}$ since Hanaoka discloses that this is known structure used for light emitting devices. One would have been motivated to make such a modification since it would allow the layer to exhibit light transmission properties, allowing the light to transmit readily through the layer, and desirable electrical properties for tuning the light emitting device.

b. Regarding claims 7 and 8, **Yamada in view of Sasaoka and Stintz disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, wherein the contact layer is doped with a p - type impurity element (Yamada: col. 8, line 41). Yamada, Sasaoka, and Stintz are silent with respect to the layer having a carrier concentration of $1 \times 10^{17} \text{ cm}^{-3}$ to $1 \times 10^{18} \text{ cm}^{-3}$.**

Hanaoka teaches that p-type contact layers may be doped with a carrier concentration of $1 \times 10^{18} \text{ cm}^{-3}$ (col. 3, lines 48 – 49).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the contact layer of Yamada in view of Sasaoka and Stintz to have a p-type impurity concentration of $1 \times 10^{18} \text{ cm}^{-3}$ since Hanaoka discloses that this is known contact layer structure used in light emitting devices. One would have been motivated to make such a modification since it would allow the layer to exhibit light transmission properties, allowing the light to transmit readily through the layer, and desirable electrical properties for tuning the light emitting device.

10. Claims 12, 13, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada in view of Sasaoka and Stintz, as applied to claim 1 above, and in further view of Morita et al. (US 6,121,636, prior art of record). **Yamada in view of Sasaoka and Stintz disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, however Yamada, Sasaoka,**

and Stintz are silent with respect to a multilayered metallic reflecting mirror made of the same material identical to the Ohmic electrode for reflecting light emitted from the light-emitting layer to the outside, which is provided on a first side of the crystalline substrate.

Morita discloses a mirror on the outside first side of the crystalline substrate (e.g. figure 1, reflecting layer 11) wherein the metallic reflecting mirror contains a metallic material identical to that contained in the Ohmic electrode (e.g. col. 4, lines 1 – 9, discloses that the layer may be made of gold, which is the same material as the electrode 9). Morita further discloses that the layers may be multilayered (col. 2, lines 21 - 25).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the light emitting device of Yamada in view of Sasaoka and Stintz to include the reflecting mirror, as taught by Morita, since Morita discloses that multilayer reflecting mirrors, made of the same material as the electrode, can be added to light emitting devices. One would be motivated to add a reflecting mirror on the second side of the substrate in order to prevent light escaping from the bottom of the device, thereby protecting underlying structures, as taught in Morita in col. 8, lines 33 - 44. One would be motivated to make the reflecting mirror multilayered to enhance its reflecting ability. One would further be motivated to make the mirror of the same material as that of the Ohmic electrode since it would require fewer materials for the production process.

11. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada in view of Sasaoka and Stintz, as applied to claim 1 above, and in further view of Kaneyama et al. (US 6,452,214 B2, prior art of record). **Yamada in view of Sasaoka and Stintz disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, however Yamada, Sasaoka, and Stintz are silent with respect to a metallic reflecting mirror containing a single-metal film or an alloy film formed from at least one member selected from the group consisting of silver, platinum, rhodium and aluminum.**

Kaneyama teaches a metallic reflecting mirror formed from aluminum (col. 4, lines 32 - 35).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the light emitting device of Yamada in view of Sasaoka and Stintz to include the reflecting mirror, as taught by Kaneyama, since Kaneyama discloses that reflecting mirrors made of aluminum can be added to light emitting devices. One would be motivated to add an aluminum reflecting mirror on the second side of the substrate in order to prevent light escaping from the bottom of the device, thereby protecting underlying structures, and aluminum is a readily available material that is can be relatively easily deposited on substrates via known deposition methods (i.e. sputtering, evaporation, etc...)

12. Claims 20 – 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada in view of Sasaoka and Stintz as applied to claim 1 above, and further in view of Lester (US 6,291,839 B1, prior art of record).

a. Regarding claim 20, **Yamada in view of Sasaoka and Stintz disclose a gallium nitride compound semiconductor light-emitting device according to claim 1, but are silent with respect to apertures are formed such that a total surface area of the apertures accounts for 30% to 80% of a surface of the contact layer.**

Lester discloses a gallium nitride compound semiconductor light-emitting device (e.g. figure 1), wherein apertures are formed in an Ohmic electrode (openings in p-type contact 20, as disclosed in col. 3, lines 1 - 3) such that a total surface area of the apertures accounts for 30% to 80% of a surface of the contact layer (as disclosed in col. 4, lines 34 - 35).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the gallium nitride semiconductor light-emitting device of Yamada in view of Sasaoka and Stintz such that the Ohmic electrode comprises a apertures with a total surface area of 30 - 80% of the surface of contact layer since Lester discloses a similar device with similar structure wherein apertures with such configurations may be formed. One would have been motivated to have apertures of such dimensions in order to optimize light transmittance from the device while providing an even Ohmic contact, as discussed by Lester (col. 3, lines 34 - 40).

b. Regarding claim 21, **Yamada in view of Sasaoka and Stintz disclose gallium nitride compound semiconductor light-emitting device according to claim 1, wherein a metallic film consists the Ohmic electrode** (Yamada: col. 10, lines 42 – 43 disclose electrode 112 to be gold and nickel). **Yamada in view of Sasaoka and Stintz are silent with respect to a minimum horizontal width (lateral width) of the metallic film consisting the Ohmic electrode is 10 μm or less, and a horizontal width of the aperture is 0.5 μm to 50 μm .**

Lester discloses a gallium nitride compound semiconductor light-emitting device (e.g. figure 1), wherein a horizontal width of the aperture is 0.5 μm to 50 μm (e.g. figure 1 and col. 3, lines 1 -3 disclose that the Ohmic layer may comprise openings (apertures). Col. 3, lines 21 – 22 disclose the dimensions of the openings). Lester also discloses that a total surface area of the apertures accounts for 30% to 80% of a surface of the contact layer (as disclosed in col. 4, lines 34 - 35).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the device of Yamada in view of Sasaoka and Stintz such that the Ohmic electrode comprises apertures with a horizontal width of 0.5 μm to 50 μm since Lester discloses a similar device with an Ohmic layer comprising apertures of such dimensions. One would have been motivated to have the apertures of a width between 0.5 μm to 50 μm in order to maximize

current flow in the Ohmic contact while optimizing the light transmittance through the apertures of the Ohmic layer, as discussed by Lester (col. 3, lines 5 – 22).

The combination of Yamada in view of Sasaoka and Stintz with the teachings of Lester disclose a device that is obvious over the limitation of a minimum horizontal width (lateral width) of a metallic film consisting the Ohmic electrode is 10 μm or less. Yamada discloses the device to have an area of 350 μm square (col. 10, line 53), of which the Ohmic layer of Yamada in view of Sasaoka and Lester comprises a large portion (e.g. as seen in figures 1 of Yamada and Lester). Since Lester discloses the total surface area of the apertures to account for 20 - 80% of the surface area, and the dimensions of the apertures to be 0.5 – 20 μm , one may do the calculations to find the average horizontal distance between the apertures to be about 0.4 μm .

Although this calculation is done using an estimated contact layer size similar to the size of the area of device as disclosed by Yamada, and average homogeneous distribution of apertures within the Ohmic contact layer, a prima facie case of obviousness is established that a minimum horizontal width of the metallic film comprising the Ohmic electrode is 10 μm or less, and it has been held that when the prior art discloses the general conditions of the claimed invention, discovering the optimum or workable ranges involves only ordinary skill in the art. See MPEP 2144.05. One would have been motivated to have a minimum horizontal distance of the metallic film comprising the Ohmic electrode

of 10 μm or less in order to optimize the current flow in the Ohmic contact while optimizing the light transmittance through the apertures of the Ohmic layer, as discussed by Lester (col. 3, lines 5 – 22).

c. Regarding claim 22, **Yamada in view of Sasaoka and Stintz and in further view of Lester disclose a gallium nitride compound semiconductor light-emitting device according to claim 20, wherein a horizontal width of the aperture is 0.5 mm to 50 mm (Lester: col. 3, line 22).**

Regarding the claim limitation “wherein a minimum horizontal width (lateral width) of a metallic film consisting the Ohmic electrode is 10 mm or less”, the combination of Yamada in view of Sasaoka and Stintz with the teachings of Lester disclose a device that is obvious over the limitation of a minimum horizontal width (lateral width) of a metallic film comprising the Ohmic electrode is 10 μm or less. Yamada discloses the device to have an area of 350 μm square (col. 10, line 53), of which the Ohmic layer of Yamada in view of Sasaoka and Lester comprises a large portion (e.g. as seen in figures 1 of Yamada and Lester). Since Lester discloses the total surface area of the apertures to account for 20 - 80% of the surface area, and the dimensions of the apertures to be 0.5 – 20 μm , one may do the calculations to find the average horizontal distance between the apertures to be about 0.4 μm .

Although this calculation is done using an estimated contact layer size similar to the size of the area of device as disclosed by Yamada, and average homogeneous distribution of apertures within the Ohmic contact layer, a prima facie case of obviousness is established that a minimum horizontal width of the metallic film comprising the Ohmic electrode is 10 μm or less, and it has been held that when the prior art discloses the general conditions of the claimed invention, discovering the optimum or workable ranges involves only ordinary skill in the art. See MPEP 2144.05. One would have been motivated to have a minimum horizontal distance of the metallic film comprising the Ohmic electrode of 10 μm or less in order to optimize the current flow in the Ohmic contact while optimizing the light transmittance through the apertures of the Ohmic layer, as discussed by Lester (col. 3, lines 5 – 22).

Response to Arguments

13. Applicant's arguments with respect to claim 1 and the amendment "*the at least one gallium nitride compound semiconductor well layer is a discontinuous layer including a portion having a thickness of 0 nm*" have been considered but are moot in view of the new ground(s) of rejection. As cited above, the prior art of Yamada may be considered to disclose such a limitation since Yamada discloses the well layer to have portions less than a half of an average thickness of the well layer (col. 13, lines 20 - 23). Furthermore, the prior art of Stintz discloses that quantum well layers may have portions

with zero thickness, which create a quantum confinement region (quantum dot region) within the well layers.

14. Applicant's arguments regarding the Examiners interpretation of the multiple quantum well structure, filed October 22, 2009 have been fully considered but they are not persuasive. In particular, the Applicant argues that the Examiners interpretation of the multiple quantum well structure to comprise only layers 108 and not layer 109 is not valid, and argues that layer 109 must be included in the structure. However, the term "structure" is a broad term, and is defined as "something that is constructed" (Merriam-Webster's Collegiate Dictionary, 10th Edition, 2001). Indeed, the structure of the multiple quantum well may be considered to comprise layers 107 and 108, since these layers are constructed, and need NOT include layer 109. Although the Examiner acknowledges the Applicants argument that layers 108 and 109 work together within the device, this can be said of ALL the layers within the device, since all the sub-components are performing a function within the device. Therefore, the Examiner maintains that the interpretation of the multiple quantum well structure as comprising layers 107 and 108 is valid, as per MPEP 2113 (broadest reasonable interpretation).

15. In response to applicant's argument that there is no suggestion to combine the references of Yamada and Sasaoka, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so

found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the prior art of Yamada discloses the barrier layer, but is simply silent the doping of the layer. Sasaoka is used to teach that barrier layers may be doped with the claimed element and concentration. Examiner has provided motivation for combining the references, in particular for at least the reason of creating an n-type semiconductor barrier layer, and allowing one to control the conductivity of the barrier layer, resulting in a more efficient light emission properties of the quantum well. Furthermore, it is well within the level of one of ordinary skill in the art to optimize the layer doping element and concentration since it has been held that when the prior art discloses the general conditions of the claimed invention, discovering the optimum or workable ranges involves only ordinary skill in the art (See MPEP 2144.05), and it has been held that the selection of a prior art material on the basis of its suitability for its intended purpose is within the level of ordinary skill (See MPEP 2144.07).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT HUBER whose telephone number is (571)270-3899. The examiner can normally be reached on Monday - Thursday (9am - 6pm EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lex Malsawma/
Primary Examiner, Art Unit 2892

/Robert Huber/
Examiner, Art Unit 2892
January 2, 2010